



# Appendices

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# Appendix 1. Agreement in Principle

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## Agreement in Principle – Proposed Land Acquisition and Exchange

### Between

### Yukon Flats National Wildlife Refuge and Doyon, Limited

Doyon, Limited, an Alaska Native Claims Settlement Act (ANCSA) Corporation<sup>1</sup>, currently owns 1.25 million acres within the exterior boundary of Yukon Flats NWR. Negotiators for Doyon and the U.S. Fish and Wildlife Service, Alaska Region, have agreed in principle to provide Doyon title to some refuge lands that may hold developable oil and gas resources. In exchange, the Service will receive habitat currently owned by Doyon within the refuge boundary. This will consist of wetlands previously identified by the Service as quality fish and wildlife habitat. As a result of the exchange, there will be less privately owned land within refuge boundaries. Phase 1 of the agreement includes a land exchange, final allocation of Doyon's ANCSA 12(b) entitlement outside of the refuge boundary, and the exchange of additional scattered land parcels to consolidate public and private lands and facilitate land management for both Doyon and the Service. If Doyon subsequently finds and chooses to develop oil and/or gas, Phase 2 of the agreement calls for the creation of a land acquisition and facility development account funded by production payments from Doyon's oil and gas production; it also provides for the Service to purchase additional Doyon lands within the refuge at fair market value and to purchase lands in other refuges in Alaska.

The key elements of this agreement are as follows:

#### Phase 1:

- Doyon will take title to approximately 110,000 acres (surface and subsurface) of refuge lands that have prospects for developable oil and gas deposits ("core lands"). The core lands lie in the south-central portion of the refuge around Beaver Creek south of the village of Birch Creek.
- Doyon will also take title to approximately 97,000 acres of subsurface oil and gas interests in a "halo" of lands around the core lands and other Doyon holdings within the refuge. If marketable oil and gas resources are discovered, Doyon will be able to access their halo land interests only by directional drilling from their adjacent surface holdings. No surface occupancy or surface construction will be permitted on these 97,000 acres.
- In an equal value exchange for the core lands and halo land interests, FWS will receive an estimated 150,000 acres of Doyon fee holdings (surface and subsurface) within the Yukon Flats

NWR. These lands contain quality fish and wildlife habitat and will provide expanded opportunities for public use. (The 150,000 acre estimate is based on *very preliminary* estimates of relative values of lands and interests associated with this agreement. Since appraisals have not yet been conducted, the actual acreage acquired by the FWS could be significantly more or less. Appraisals will conform to Uniform Appraisal Standards for Federal Land Acquisitions. The appraisers, as well as both parties to this agreement, will have access to the same geological, geophysical, and other data relevant to resource evaluation.)

- Doyon will also irrevocably reallocate their remaining ANCSA 12(b) entitlement (approximately 58,000 acres) outside of the Yukon Flats NWR to the village of Circle. (Doyon could, and likely would, allocate most of its remaining 58,000 acres of ANCSA 12(b) entitlement to villages within the refuge without this agreement. Under this agreement, however, Doyon commits to allocating all remaining entitlement to areas outside the refuge.)
- Doyon will retain a limited subsistence easement, mirroring the subsistence provisions of ANILCA, for local rural residents on all lands conveyed to the FWS through the exchange.
- In the area to be acquired by Doyon, the FWS will reserve a 1-mile wide public use easement along Beaver Creek (1/2 mile on each side) to protect public access to, and use of, the waterway.
- More than 125 miles of Beaver Creek, immediately upstream of the core lands, is designated “wild” under the National Wild and Scenic Rivers Act. This exchange does not include any lands in the Beaver Creek Wild River Corridor. While Doyon’s acquisition of the core lands will take some of the downstream Beaver Creek corridor out of Federal ownership, other segments of the Beaver Creek corridor will be acquired by FWS in the equal value exchange. The complete reallocation of Doyon’s 12(b) entitlements to villages outside of the refuge boundary will also ensure that other sections of the Beaver Creek corridor within the refuge boundary don’t convert from Federal to private ownership.
- Doyon and the Service will pursue some township-level equal value exchanges elsewhere in the refuge to consolidate Doyon and refuge ownership.

**Phase 2** – To be implemented if Doyon finds and chooses to develop oil and/or gas resources on the lands acquired by the initial exchange:

- An “Alaska NWR Land Acquisition and Facility Account” will be established by FWS to be used by FWS to: (1) acquire additional lands within the Yukon Flats NWR; (2) acquire other lands from willing sellers within Alaska refuges; and, as a second priority, construct facilities for Alaska refuges.
- Doyon will pay into the Alaska NWR Land Acquisition and Facility Account a production payment of 1.25% of resource value at the wellhead for all oil and gas extracted from lands and interests acquired through this agreement. The 1.25% rate for the production payment is equivalent to the Federal share of typical lease payments (10% of 12.5%) for oil and gas produced in this



region. (Establishment of this account will require legislation. If this authorization is not received, the agreement will not become effective.)

- The existing geological, geophysical and other data suggest that the chances of Doyon locating developable oil and gas deposits range from 1 in 20 to 1 in 40. Doyon would need to discover approximately 200 million barrels of recoverable oil in order for any development to be economical. A 200 million barrel field has an in-place value of \$6 billion at \$30/barrel. Under this scenario, payments into the Alaska NWR Land Acquisition and Facility Account would be approximately \$75 million, assuming a 200-million barrel recoverable reserve and oil at \$30 per barrel.
- To mitigate the impacts of oil and gas development within the refuge, Doyon agrees to sell to FWS, at fair market value, up to 120,000 acres of additional quality fish and wildlife habitats within the refuge. The acquisition of these lands would be in addition to those exchanged in Phase 1. The total acquisition of lands acquired for the refuge, through the initial Phase 1 exchange plus fair market purchases in Phase 2, will total approximately 270,000 acres. Lands acquired by FWS from willing-seller village corporations within the refuge, where Doyon simultaneously sells FWS the subsurface at fair market value, will be credited towards Doyon's 270,000 (approximate) acre total acreage commitment.
- Doyon will retain a limited subsistence easement, mirroring the subsistence provisions of ANILCA, for local rural residents on all lands purchased from them by the Service.
- If oil and gas development goes forward, Doyon will, consistent with ANILCA Title XI, file an application with BLM for a right-of-way through the White Mountains National Recreation Area to construct a road and pipeline to connect their production facilities to the trans-Alaska pipeline. A cross-refuge route may be considered as an alternative in the subsequent NEPA review. If a cross-refuge ROW is ultimately granted, mitigation measures, at a minimum, will include: (1) Doyon will convey to the FWS 640 acres of land within the refuge for each linear mile of ROW that crosses the refuge. (A ROW across the Refuge would be approximately 40 linear miles, requiring the additional conveyance of approximately 25,600 acres.) (2) The production payment on all oil and gas resources developed from the lands acquired by Doyon via the agreement will be increased from 1.25% to 1.5%. (This 0.25% increase in production payment would produce an additional \$15 million for the acquisition and facilities account, assuming a 200-million barrel recoverable reserve and oil at \$30 per barrel.)

**In summary:**

- Phase 1 of this agreement will result in Doyon receiving lands with prospects for oil and gas, while the refuge will gain an estimated net increase of 98,000 acres of quality fish and wildlife habitat; acreage that will also be available for recreation and subsistence use. The estimated net increase of 98,000 acres is calculated as: the estimated 150,000 acres to be received by FWS in the exchange *minus* the 110,000 acres of surface/subsurface conveyed to Doyon in the exchange *plus* 58,000 acres of 12(b) entitlement that will not be taken within the refuge.

- If Phase 2 is implemented, Doyon will profit from developing the oil and gas acquired in Phase 1, and the refuge will gain, through market value purchases funded by production payments from Doyon's oil and gas production, an additional 120,000 acres of quality fish and wildlife habitat that will also be available for recreation and subsistence use. The Service would then be able to continue to use such funds, as available to purchase other private lands from willing sellers within other national wildlife refuges in Alaska and, as a second priority, construct needed facilities.
- The parties to this agreement believe that implementing its provisions are in the public interest. The Service believes that, when all elements of the agreement are viewed in aggregate, the agreement will benefit the Yukon Flats Refuge, the refuge system, and the Service's trust responsibilities to fish and wildlife resources.
- Benefits to Doyon shareholders are more speculative, but could be significant under the most positive scenarios, including job training and long term employment for residents of an economically disadvantaged part of rural Alaska. Noteworthy is the fact that 70 percent of all net revenues Doyon may receive from oil and gas development must be shared by law with the other 11 ANCSA regional corporations and ANCSA village corporations statewide.

This agreement in principle will next be presented to:

- FWS and Department leadership for further policy and legal review.
- The public, for review and comment.

#### **(Footnotes)**

<sup>1</sup> Doyon, Limited was formed as a result of the 1971 Alaska Native Claims Settlement Act. It is one of 12 State chartered for profit ANCSA regional corporations mandated by Congress. Doyon has a membership of 14,000 Alaska Native shareholders, many of whom are resident in over 30 Native villages throughout interior Alaska. Consistent with Congress' ANCSA policy declaration, Doyon aims to make a positive difference in the "real economic and social well-being" of Alaska Natives shareholders. Doyon is the largest private landowner in Alaska and its ownership rights in several Federal refuges preceded their establishment in 1980. More Doyon information can be found at [www.doyon.com](http://www.doyon.com).



## Appendix 2. Maps

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### List and Description of Maps

**Map 1 – Current Land Status:** The exterior Refuge boundaries encompass over 11 million acres. Of this amount, Doyon owns 1.25 million acres; the Service owns 8.6 million acres; villages own the remainder. The map depicts the area recommended for wilderness in the 1987 Yukon Flats Refuge Comprehensive Conservation Plan, and Beaver Creek National Wild River corridor.

**Map 2 – Phase I Lands to be Exchanged and ANCSA 12(b) Selections to be Removed:** Doyon will take title (surface and subsurface) to approximately 110,000 acres (shown in yellow). Doyon also will take title to approximately 97,000 acres of subsurface oil and gas interests (shown as stippled green). In an equal value exchange, the Service will receive an estimated 150,000 acres of Doyon fee holdings (surface and subsurface), shown in blue. As part of Phase I, Doyon also will irrevocably reallocate their remaining ANCSA 12(b) entitlement (56,517 acres). This reallocation of entitlement will eventually remove most ANCSA 12(b) selections on Refuge lands (approximately 420,000 acres), shown as salmon.

**Map 3 – Phase I Consolidation Exchange:** This map shows expected land status after the primary equal value exchange and removal of ANCSA 12(b) selections. A supplemental equal value exchange will then be conducted to further consolidate Service and Doyon land ownership. Service lands to be acquired by Doyon are shown as pink. Doyon lands to be acquired by the U.S. are shown as dark green.

**Map 4 – Phase I Final:** This map shows the expected land status after all elements of Phase I are completed.

**Map 5 – Phase II Additional Service Land Acquisition and Right-of-Way Alternatives:** If Doyon develops oil and/or gas resources on Phase I acquired lands, Doyon will sell to the U.S. (at fair market value) an additional 120,000 acres, shown in blue, including one township to be acquired by Doyon from Birch Creek Village, shown in pink. Under this scenario, Doyon will apply for a right-of-way through the White Mountains National Recreation Area for a road and pipeline corridor to connect the field to the Dalton Highway and the Trans-Alaska Pipeline (Southern Route, shown in red). If through the ANILCA Title XI process a right-of-way instead is granted across the Refuge (Northern Route, also shown in red), Doyon will convey an additional section of land to the Service for every linear mile of access corridor.

**Map 6 – Phase II Final Land Status:** The expected land status after all elements of Phase I and Phase II are completed.

**Map 7 – Phase II Final Land Status:** The expected land status after all elements of Phase I and Phase II are completed. This map shows details of rights-of-way, proposed transportation corridors, highways, communities and surrounding land ownership.

**Map 8 – Breeding Waterfowl and Waterbird Densities by Township:** Average number of ducks per square mile in each township for which the Refuge has waterfowl survey data. This map is based on intensive waterfowl breeding pair surveys conducted in 1991 and 1992 (see Section III. B. 1.) The map shows lands Doyon would acquire (red outline), lands the Service would acquire (black outline), and ANCSA 12(b) selections that will remain in public ownership because Doyon will reallocate remaining entitlements outside of the Refuge (yellow outline).

**Map 9 – Swan Observations:** Survey data from six separate swan surveys, conducted from 1975 to 2000. One dot represents an observation of one or more swans. The red dots show 2000 data used to determine swan density and the yellow dots show observations from previous surveys. The lands Doyon would acquire are outlined in red, the lands the Service would acquire are outlined in black, and ANCSA 12(b) selections that will remain in public ownership because Doyon will reallocate remaining entitlements outside of the Refuge are outlined in yellow.

**Map 10 – Fire Protection Levels:** Current fire protection zones of Critical, Full, and Modified are shown on this map. The remainder of the Refuge is in a Limited fire protection zone. The map shows lands Doyon would acquire (red outline), lands the Service would acquire (black outline), and ANCSA 12(b) selections that will remain in public ownership because Doyon will reallocate remaining entitlements outside of the Refuge (blue outline).

**Map 11 – Fire History:** Shows perimeters of wildland fires from 1950 to 2004. From 1950 to 1959 there was no coordinated suppression response. From 1960 to 1983 the policy was to initially attack all fires. From 1984 to 2004 the Refuge fire management plan, which zones the Refuge into different fire protection levels, has guided fire protection (depicted in Map 10).

**Map 12 – Special Use Areas and Potential Rights-of-Way (ROW):** The 1987 wilderness recommendation (blue crosshatching), the Beaver Creek Wild and Scenic River Corridor (light blue outline), the White Mountain National Recreation Area and the Steese National Conservation Areas (brown outline) are depicted to show the proximity of the Doyon exchange lands, the subsurface halo lands and potential ROWs to these special use areas.

**Map 13 – Public Use Easements and Permitted Cabin Locations:** This map depicts the planned public use easement for Beaver Creek. This easement would ensure Refuge visitors have full use and access to a corridor at least one half mile from the banks of Beaver Creek. The Service also may reserve two, ANCSA 17(b) trail easements linking Beaver Creek and Refuge lands. These trails would enable Refuge visitors to travel to and from Refuge lands across Doyon lands. The map also depicts the 1987 wilderness recommendation boundary and the Beaver Creek Wild River Corridor in greater detail.



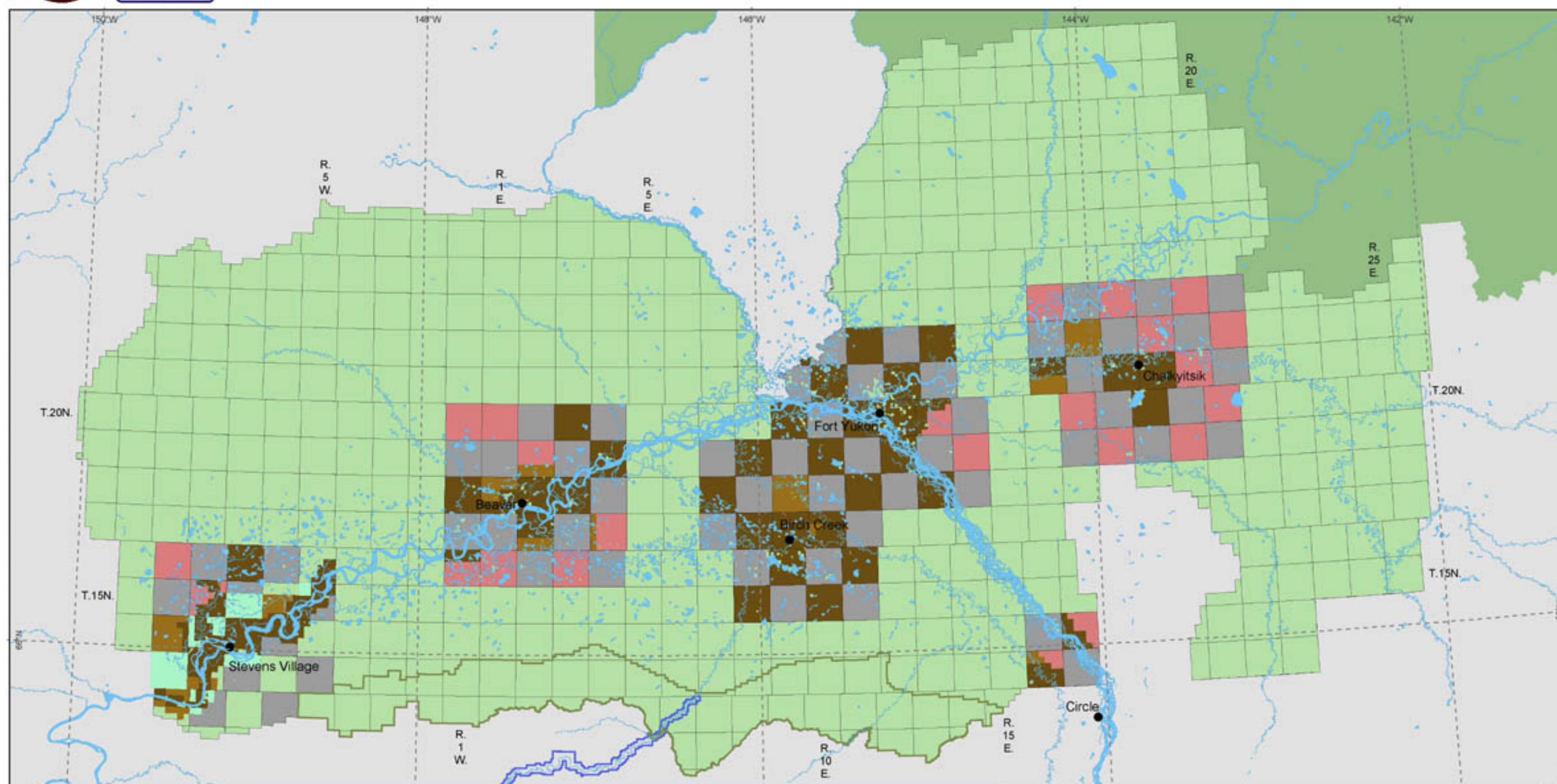


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## Yukon Flats National Wildlife Refuge, Alaska

FWS/Doyon Agreement - Map 1

Current Land Status

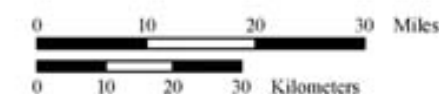


### Land Status

- Yukon Flats NWR
- Conveyed Doyon Lands
- Conveyed Village Lands
- Selected 12(b) Village Lands

- Selected 12(a) Village Lands
- Conflicting Selections (Stevens Village 12(a) and Doyon)
- 1987 Wilderness Recommendation

- Wild & Scenic River Corridor
- Arctic NWR
- Non-Refuge Lands



Produced in the Division of Realty  
Anchorage, Alaska  
Current to: December 27, 2004



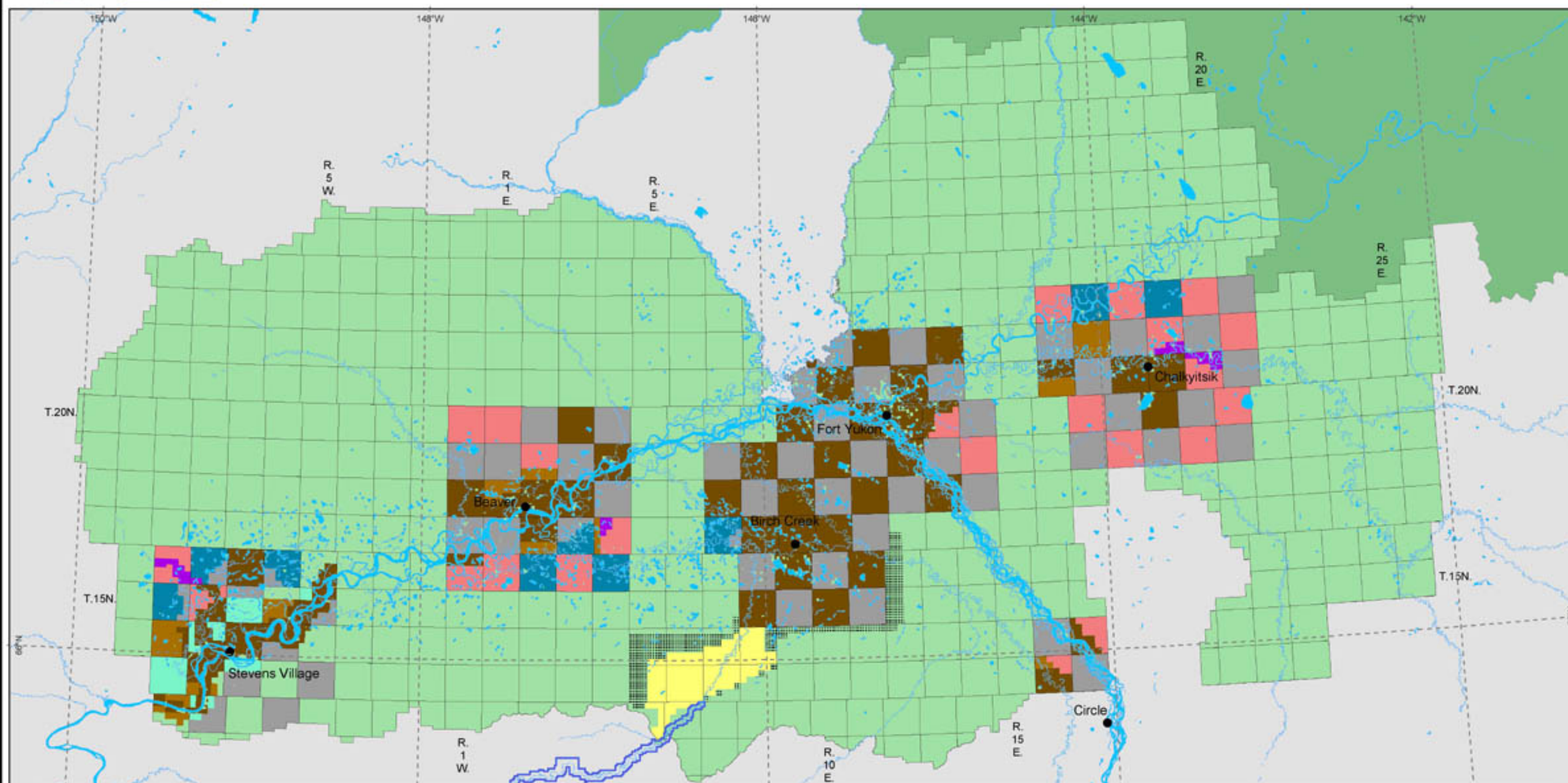


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## Yukon Flats National Wildlife Refuge, Alaska

FWS/Doyon Agreement - Map 2

Phase I: Land to be exchanged and ANCSA 12(b) selections to be removed



### Land Status

- |  |   |  |
|--|---|--|
| FWS Lands to Doyon   | Yukon Flats NWR                                       | Selected 12(a) Village Lands                             |
| FWS Oil & Gas Interests to Doyon (Halo Lands)  | Conveyed Doyon Lands                                  | Conflicting Selections (Stevens Village 12(a) and Doyon) |
| Doyon Lands to FWS   | Conveyed Village Lands                                | Wild & Scenic River Corridor                             |
| Selected 12(b) Village Lands to be Removed (Entitlement is Approx. 3 of the 23 Selected Townships) | Remaining 12(b) Selections to be Conveyed to Villages | Arctic NWR   |
|  |   | Non-Refuge Lands   |

0 10 20 30 Miles  
0 10 20 30 Kilometers



Produced in the Division of Realty  
Anchorage, Alaska  
Current to: December 27, 2004

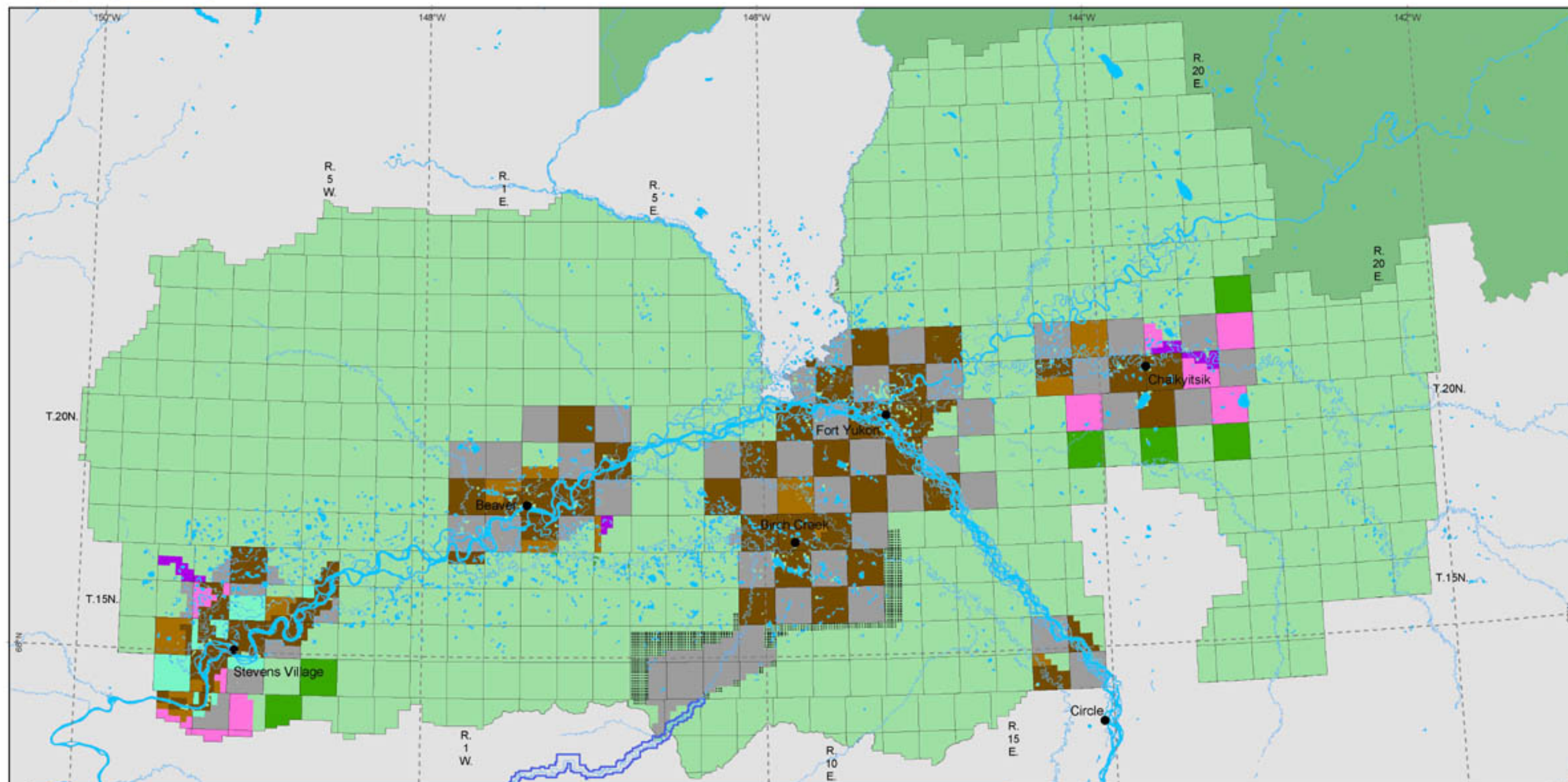




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## Yukon Flats National Wildlife Refuge, Alaska

*FWS/Doyon Agreement - Map 3*  
*Phase I: Consolidation Exchange*



### Land Status

- |                    |   |  |
|--------------------|---|--|
| FWS Lands to Doyon | FWS Lands with Doyon Oil & Gas Ownership (Halo Lands) | Selected 12(a) Village Lands                             |
| Doyon Lands to FWS | Conveyed Doyon Lands                                  | Conflicting Selections (Stevens Village 12(a) and Doyon) |
| Yukon Flats NWR    | Conveyed Village Lands                                | Wild & Scenic River Corridor                             |
|                    | Remaining 12(b) Selections to be Conveyed to Villages | Arctic NWR   |
|                    |   | Non-Refuge Lands   |

0 10 20 30 Miles  
0 10 20 30 Kilometers



Produced in the Division of Realty  
Anchorage, Alaska  
Current to: December 27, 2004



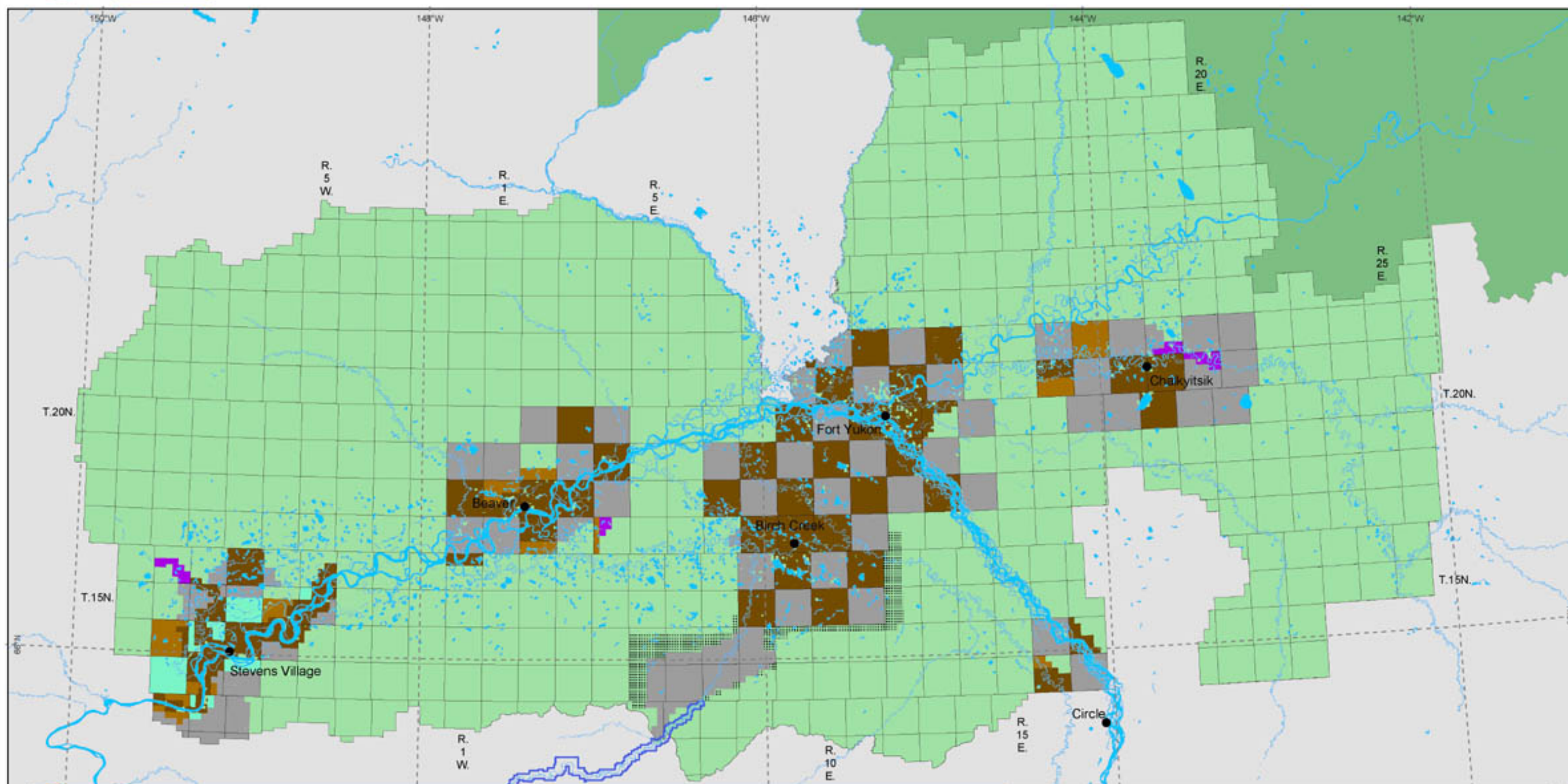


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## Yukon Flats National Wildlife Refuge, Alaska

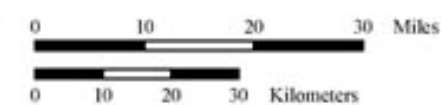
FWS/Doyon Agreement - Map 4

Phase I: Final



### Land Status

- |   |   |  |
|---|---|--|
| Yukon Flats NWR                                       | Conveyed Village Lands                                | Conflicting Selections (Stevens Village 12(a) and Doyon) |
| FWS Lands with Doyon Oil & Gas Ownership (Halo Lands) | Remaining 12(b) Selections to be Conveyed to Villages | Wild & Scenic River Corridor                             |
| Conveyed Doyon Lands                                  | Selected 12(a) Village Lands                          | Arctic NWR   |
|   |   | Non-Refuge Lands   |



Produced in the Division of Realty  
Anchorage, Alaska  
Current to: December 27, 2004



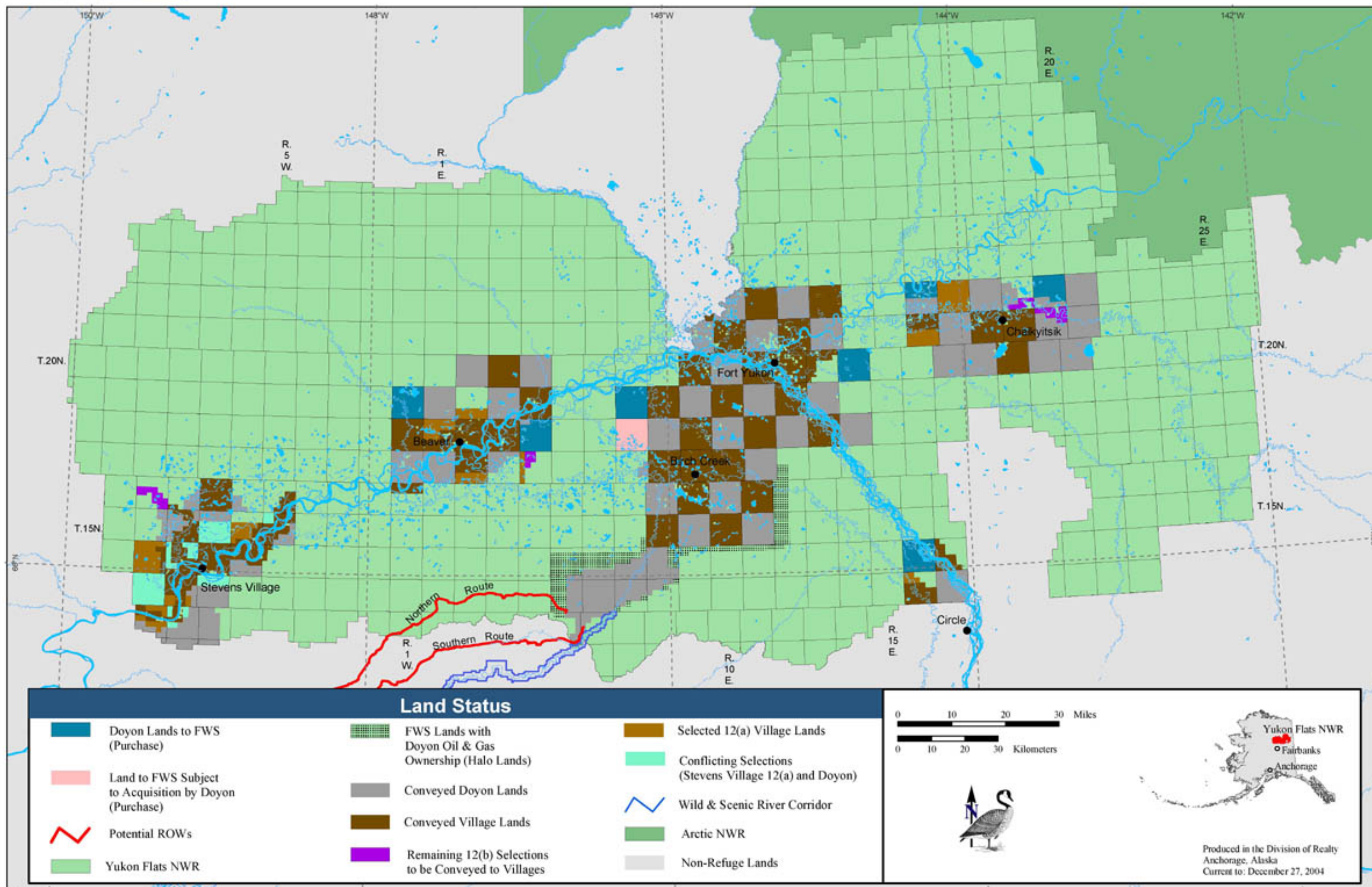


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## Yukon Flats National Wildlife Refuge, Alaska

FWS/Doyon Agreement - Map 5

Phase II: Additional USFWS acquisitions and ROWs





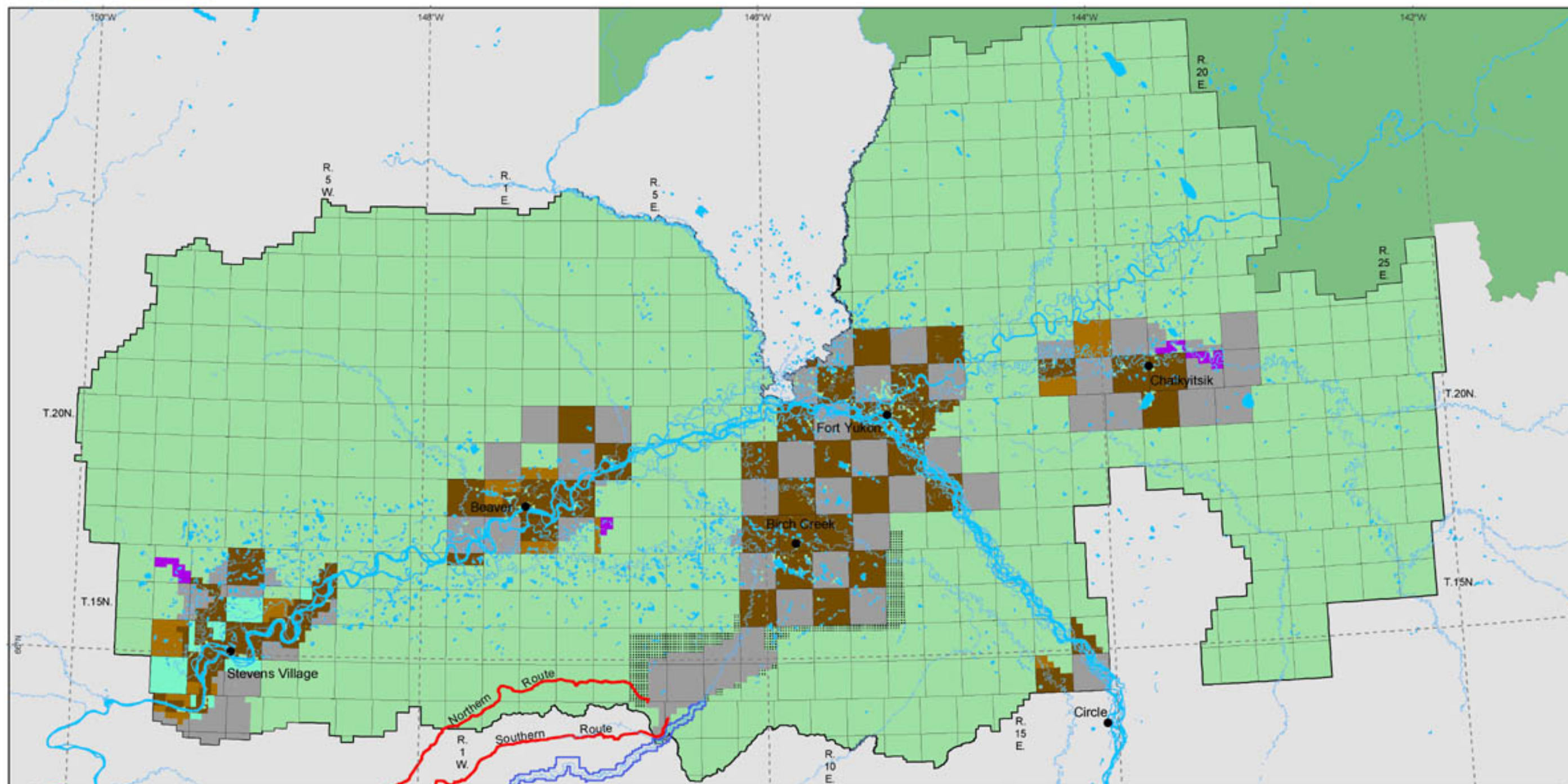


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# Yukon Flats National Wildlife Refuge, Alaska

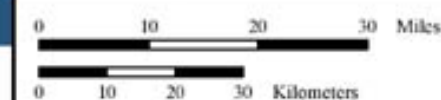
FWS/Doyon Agreement - Map 6

Phase II: Final



## Land Status

- |   |  |                              |
|---|--|------------------------------|
| Yukon Flats NWR                                       | Remaining 12(b) Selections to be Conveyed to Villages    | Potential ROWs               |
| FWS Lands with Doyon Oil & Gas Ownership (Halo Lands) | Selected 12(a) Village Lands                             | Wild & Scenic River Corridor |
| Conveyed Doyon Lands                                  | Conflicting Selections (Stevens Village 12(a) and Doyon) | Arctic NWR                   |
| Conveyed Village Lands                                |  | Non-Refuge Lands             |



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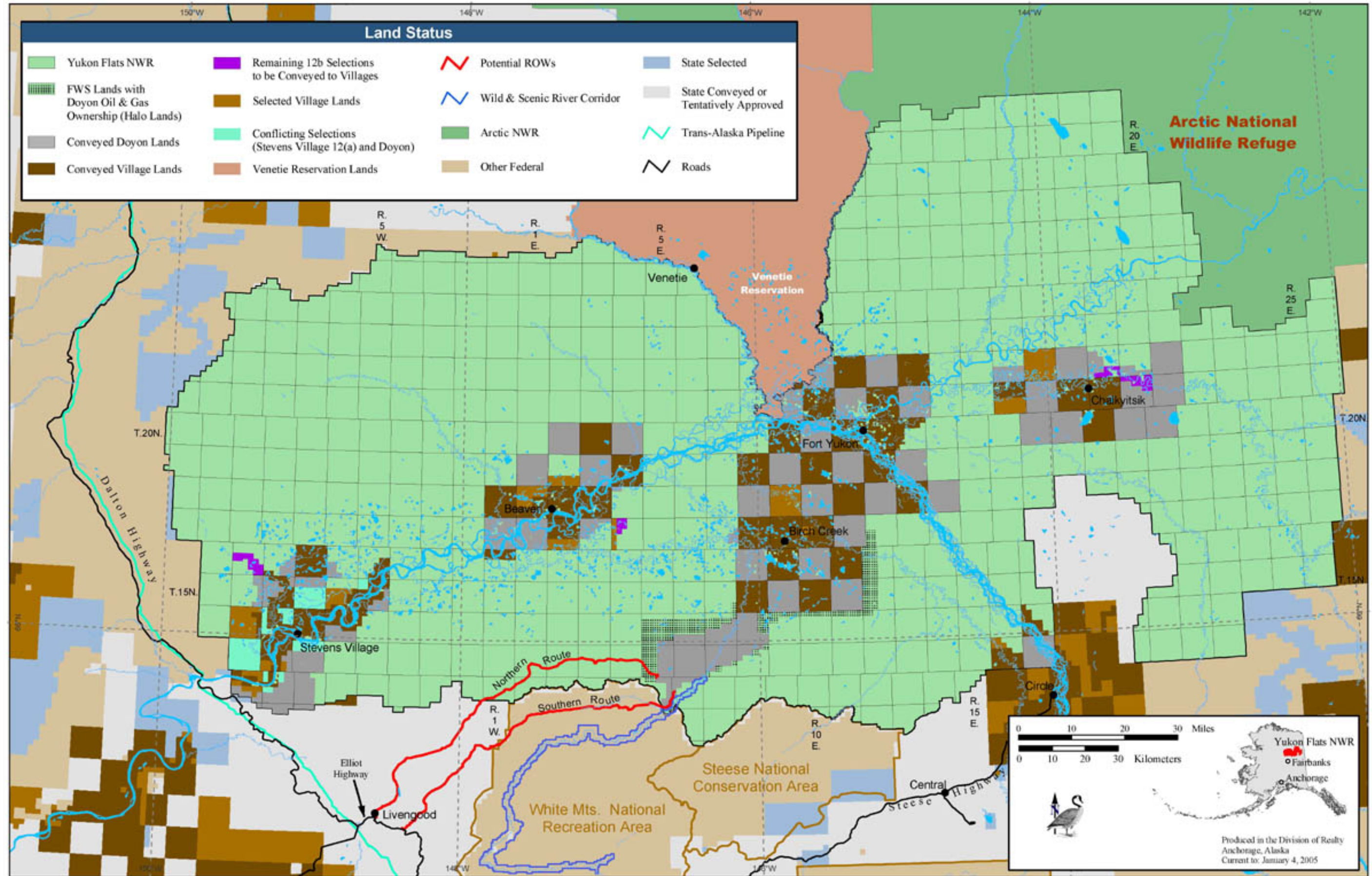


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## Yukon Flats National Wildlife Refuge, Alaska

FWS/Doyon Agreement - Map 7

Phase II: Final



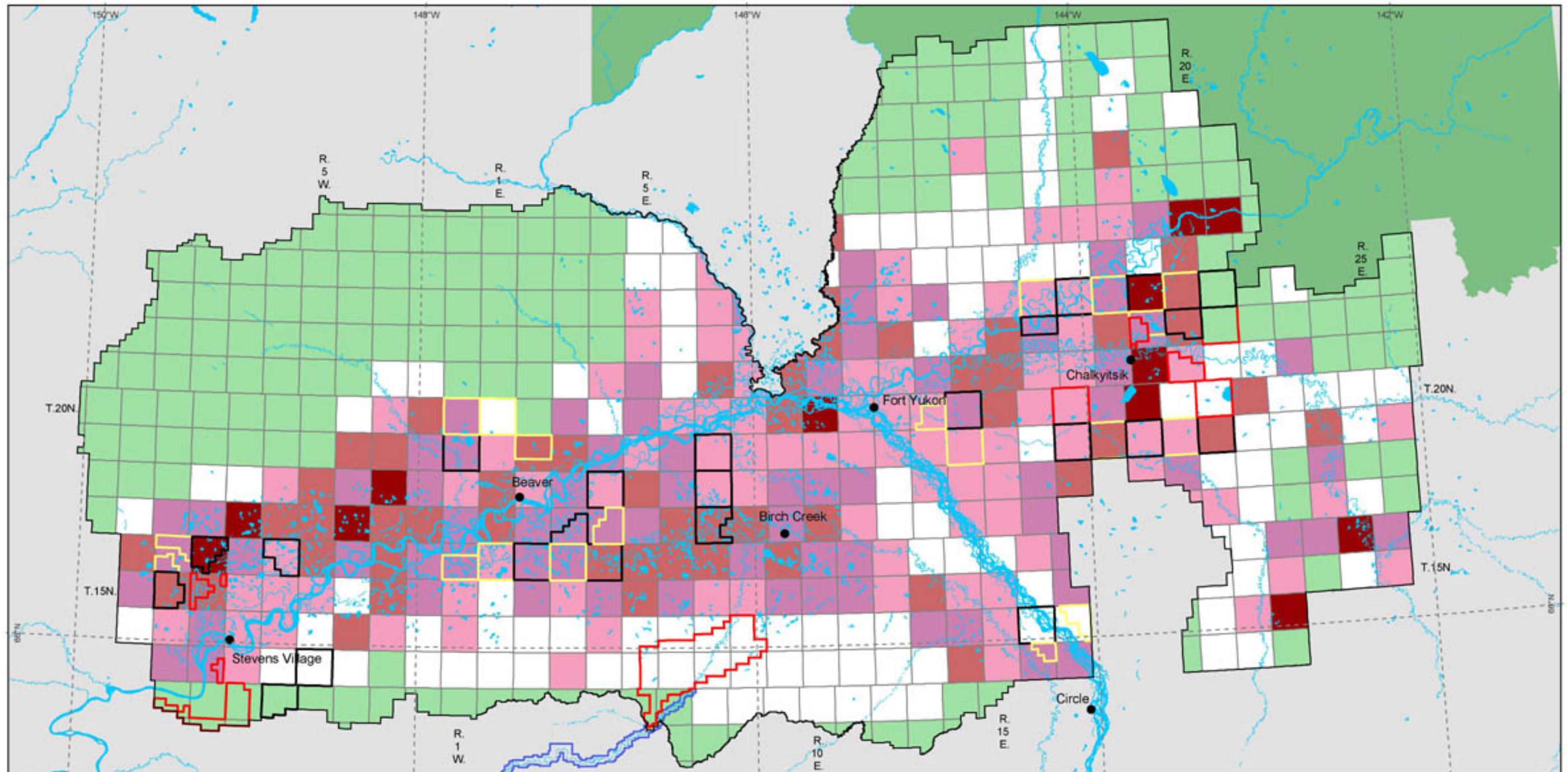




U.S. Fish & Wildlife Service

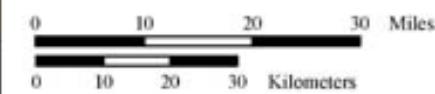
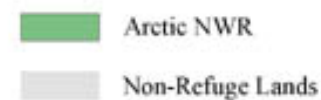
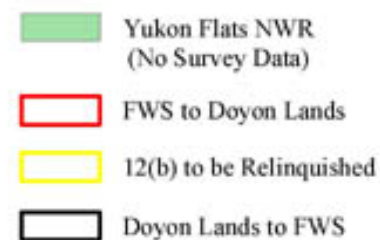
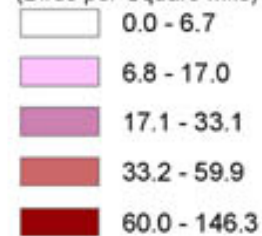
Yukon Flats National Wildlife Refuge, Alaska

*Breeding Densities of Waterfowl and other Waterbirds Across the  
Yukon Flats Waterfowl Survey Area - Map 8*



### Land Status

Waterfowl and Waterbird Densities by Township  
(Birds per Square Mile)



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Anchorage, Alaska  
Current to: December 27, 2004



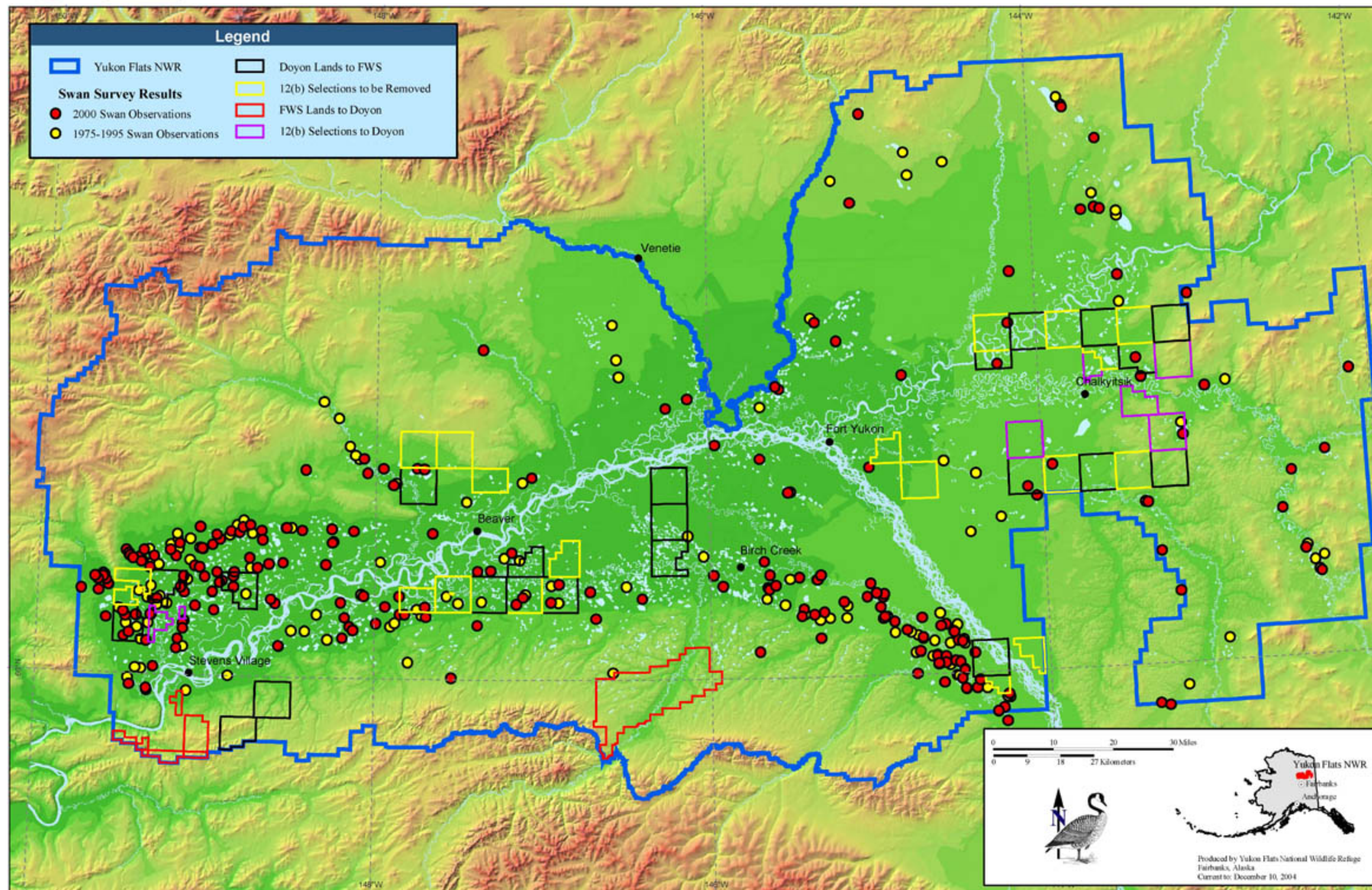


U.S. Fish & Wildlife Service

## Yukon Flats National Wildlife Refuge, Alaska

Swan Observations - Map 9

1975-2000



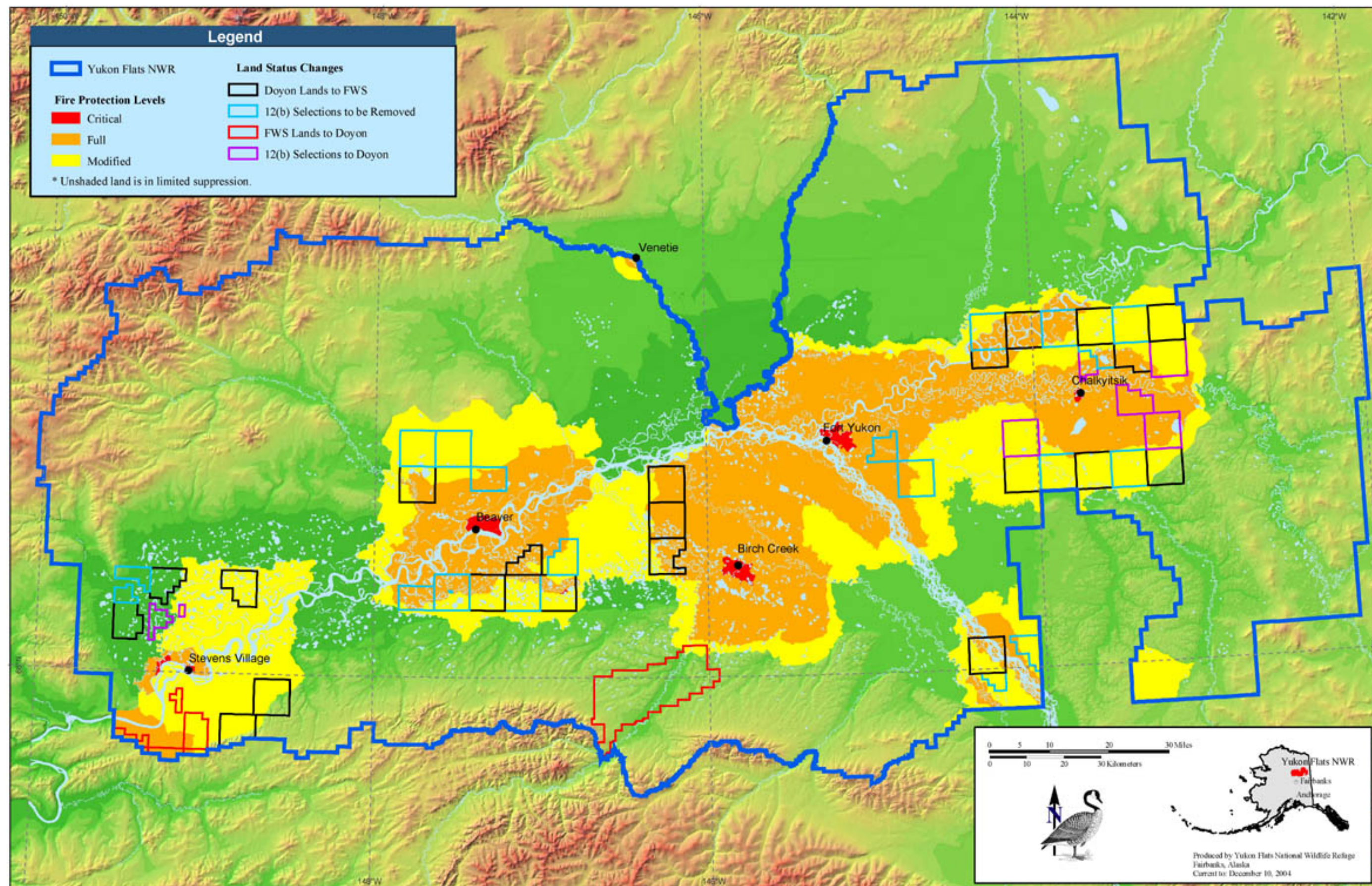




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## Yukon Flats National Wildlife Refuge, Alaska

Fire Protection Levels - Map 10





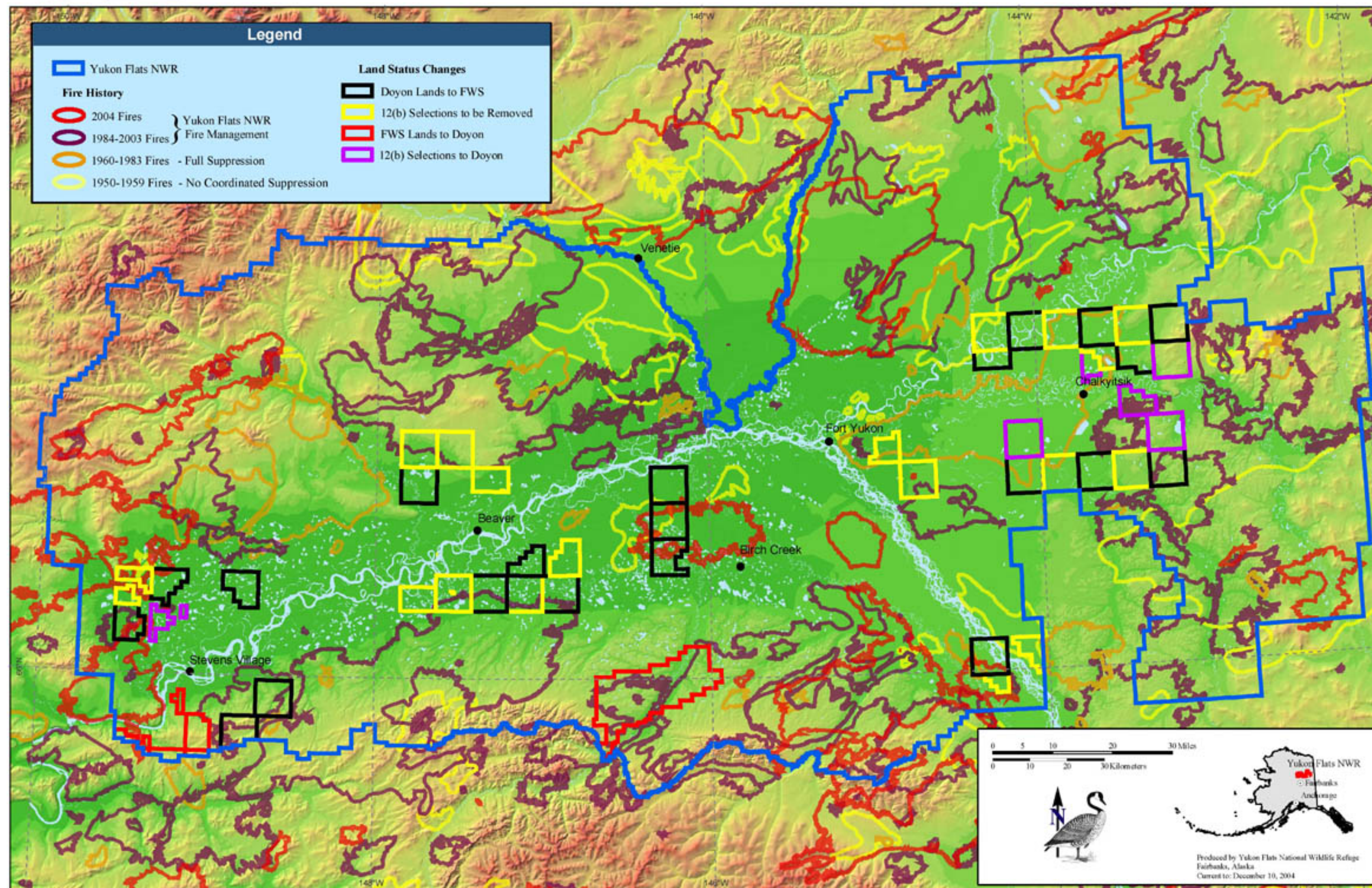


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## Yukon Flats National Wildlife Refuge, Alaska

Fire History - Map 11

1950-2004



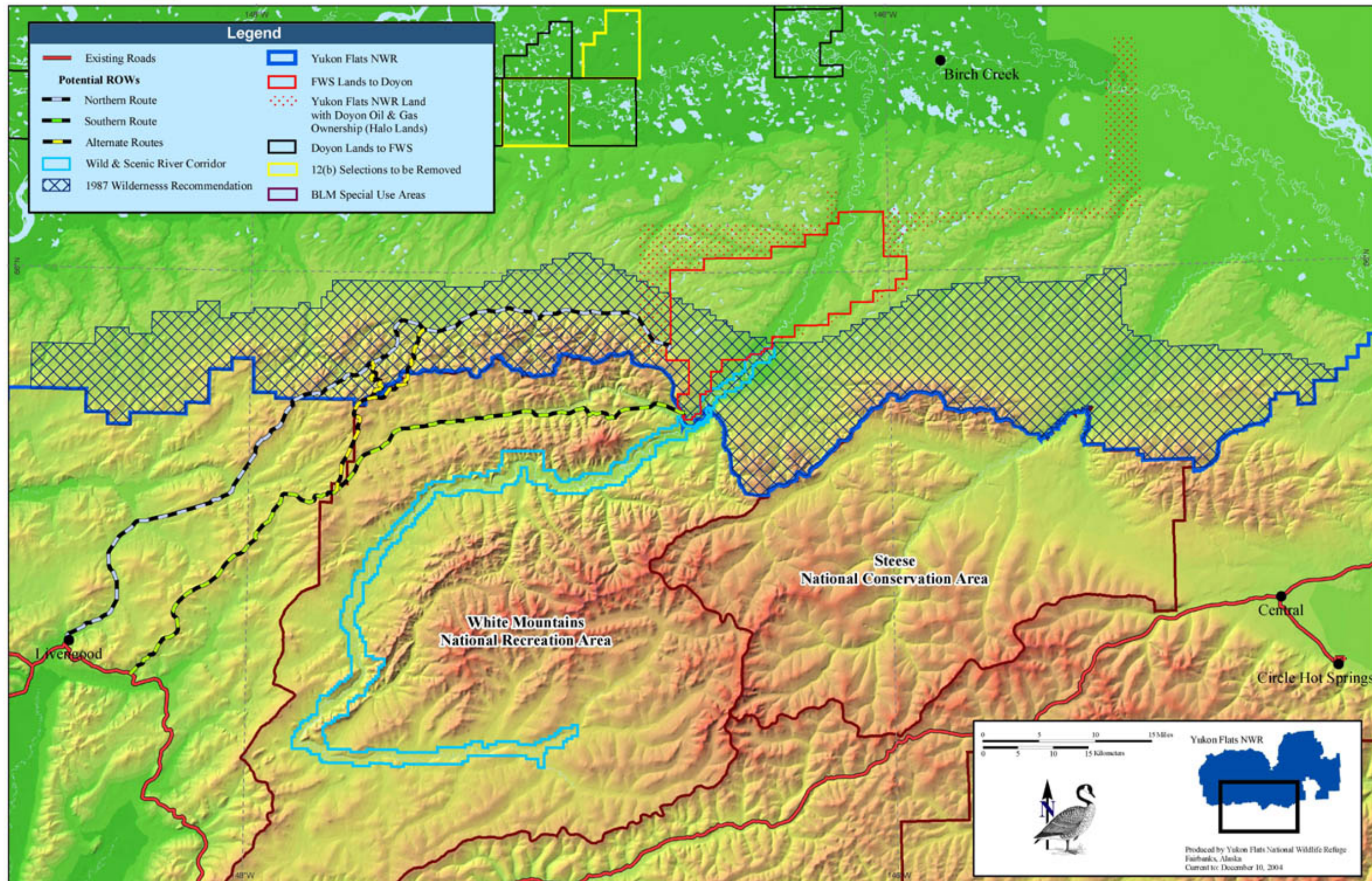




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## Yukon Flats National Wildlife Refuge, Alaska

Special Use Areas - Map 12  
& Potential ROWs



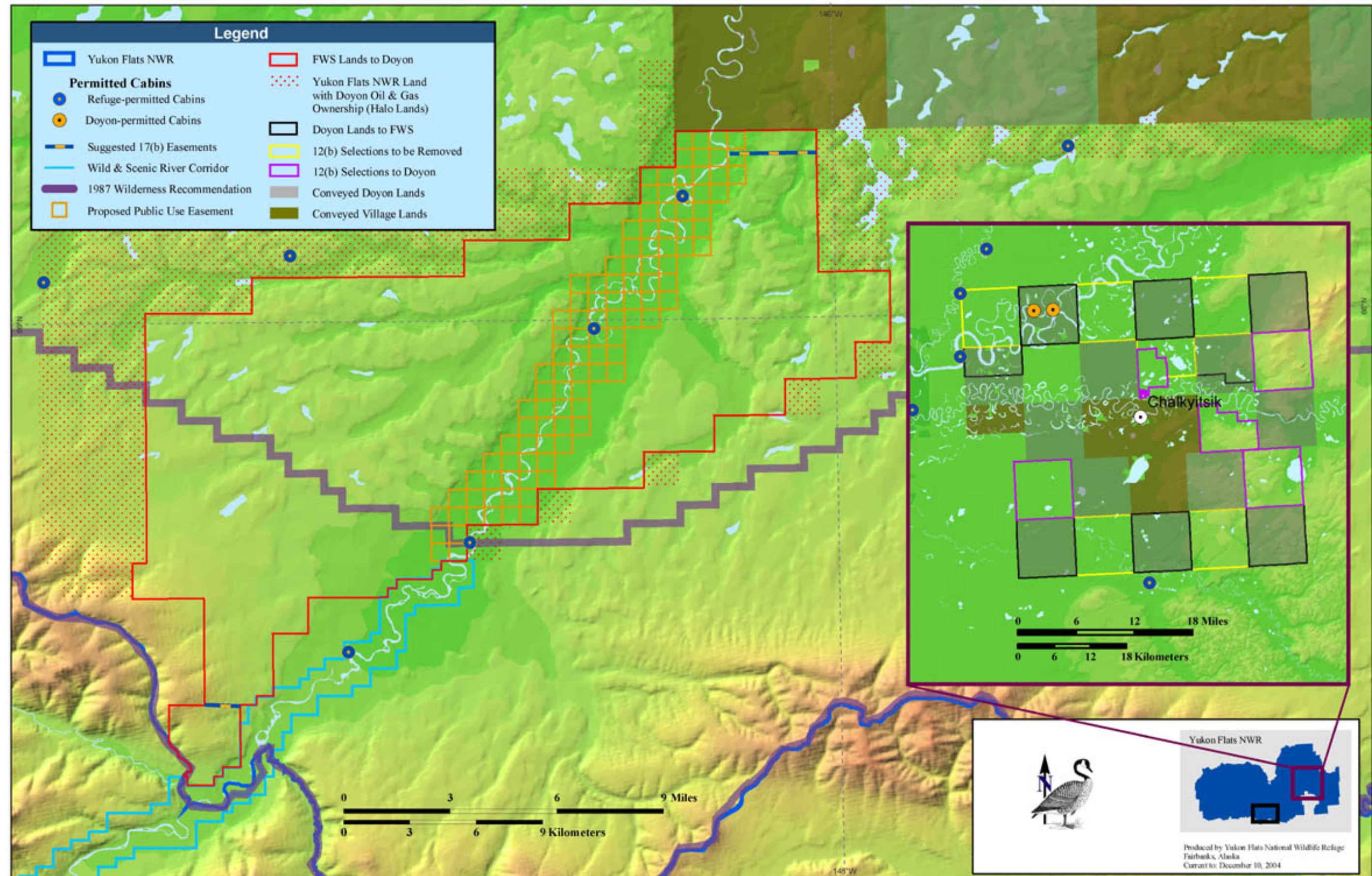




U.S. Fish & Wildlife Service

# Yukon Flats National Wildlife Refuge, Alaska

Public Use Easements - Map 13  
& Permitted Cabins







## **Appendix 3. Oil and Gas Assessment of Yukon Flats**

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## National Assessment of Oil and Gas Fact Sheet

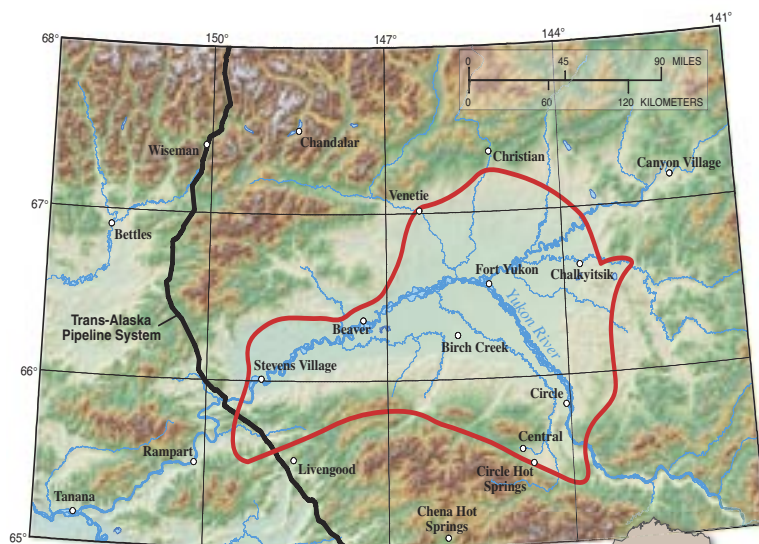
# Oil and Gas Assessment of Yukon Flats, East-Central Alaska, 2004

**T**he U.S. Geological Survey (USGS) recently completed a new assessment of undiscovered oil and gas resources for the Yukon Flats Tertiary Composite Total Petroleum System in east-central Alaska. The assessment indicates the probable existence of technically recoverable oil and gas resources, with mean estimates of about 5.5 trillion cubic feet of undiscovered natural gas, 173 million barrels of undiscovered oil, and 127 million barrels of natural-gas liquids in conventional accumulations.

### Introduction

Yukon Flats is a region of low, forested hills and flatlands with numerous streams and lakes, situated generally to the east of the Trans-Alaska Pipeline System in east-central Alaska. U.S. Geological Survey (USGS) scientists recently finished their first detailed assessment of the undiscovered oil and gas potential of the Yukon Flats region. Previously, the region's potential had been assessed only as a part of larger oil and gas assessments for central Alaska.

At present, there is no commercial petroleum production in the Yukon Flats region, but the new USGS assessment indicates the probable existence of technically recoverable oil and gas resources—in other words, those resources that can be discovered, developed, and produced by using current technology—in rocks of Tertiary age (about 1.8 to 65 million years old). The assessment was based on the general geologic elements used to define a Total Petroleum System (TPS), which include hydrocarbon source rocks



U.S. Geological Survey scientists recently finished their first detailed assessment of the undiscovered oil and gas potential of the Yukon Flats Tertiary Composite Total Petroleum System (red outline) of east-central Alaska. The assessment indicates the probable existence of technically recoverable oil and gas resources.



The 13,500-square-mile (35,000 km<sup>2</sup>) Yukon Flats assessment area is characterized by low, forested hills, flatlands, meadows, meandering streams, and lakes. This photograph, taken northwest of Circle, Alaska, shows a typical landscape of the region.

(source-rock maturation, hydrocarbon generation, and hydrocarbon migration), reservoir rocks (sequence stratigraphy and

petrophysical properties), and hydrocarbon traps (trap formation and timing). The Yukon Flats TPS is a "composite" petro-

leum system because available geologic evidence suggests that it contains multiple horizons of petroleum source rocks—including shale, mudstone, and coal of Tertiary and Mesozoic age—rather than a single horizon of source rock, as in some other petroleum systems of the world.

Using this geologic framework, the USGS defined four Assessment Units within the Yukon Flats Tertiary Composite TPS—the Tertiary Sandstone Assessment Unit, the Subthrust Assessment Unit, the Crooked Creek Assessment Unit, and the Coalbed Gas Assessment Unit. Undiscovered, conventional oil and gas resources were quantitatively assessed for the Tertiary Sandstone, Subthrust, and Crooked Creek Assessment Units. The Coalbed Gas Assessment Unit, which may contain continuous (unconventional) gas resources, was not quantitatively assessed for this study and will be considered at a future date, along with other potential coalbed-gas units in Alaska.

## Resource Summary

The USGS assessment strategy provides estimates of the volumes of undiscovered petroleum (mainly oil, gas, and natural-gas liquids) that are technically recoverable and that have the potential to be added to reserves in a 30-year forecast span. For the Yukon Flats Tertiary Composite Total Petroleum System, the USGS estimates a mean of 5.46 trillion cubic feet of gas (TCFG), a mean of 172.66 million barrels of oil (MMBO), and a mean of 126.67 million barrels of natural-gas liquids (MMBGL). Nearly all



Photograph looking northward across the Trans-Alaska Pipeline System, showing low, forested hills along the Yukon River (right-hand edge of photo), near the west edge of the Yukon Flats assessment area.

of these undiscovered resources are estimated to be within the Tertiary Sandstone Assessment Unit. Of the 5.46 TCGF of undiscovered gas at the mean, about 97% (5.28 TCGF) is believed to be within the Tertiary Sandstone Assessment Unit, less than 1% (0.02 TCGF) is in the Subthrust Assessment Unit, and about 3% (0.16 TCGF) is in the Crooked Creek Assessment Unit. Of the 172.66 MMBO of undiscovered oil at the mean, about 96% (165.57 MMBO) is believed to be within the Tertiary Sandstone Assessment Unit, less than 1% (0.61 MMBO) is in the Subthrust Assessment Unit, and about 4% (6.47 MMBO) is in the Crooked Creek Assessment Unit.

Richard G. Stanley, Thomas S. Ahlbrandt;  
Ronald R. Charpentier, Troy A. Cook,  
Jesse M. Crews, Timothy R. Klett, Paul G. Lillis,  
Robert L. Morin, Jeffrey D. Phillips,  
Richard M. Pollastro, Elisabeth L. Rowan,  
Richard W. Saltus, Christopher J. Schenk,  
Megan K. Simpson, Alison B. Till,  
and Sandra M. Troutman

Edited by James W. Hendley II  
Graphic design by Susan Mayfield and Sara Boore

### For Further Information

Supporting geologic studies of the Yukon Flats Tertiary Composite Total Petroleum System and the Assessment Units, and the methodology used in the Yukon Flats assessment, are in preparation. Assessment results are available at the USGS Central Energy Team Web site, <http://energy.cr.usgs.gov/oilgas/hoga/>.

or contact

Richard G. Stanley: [rstanley@usgs.gov](mailto:rstanley@usgs.gov) (650) 329-4918

This Fact Sheet and any updates to it are available online at <http://pubs.usgs.gov/fs/2004/3121/>

## Yukon Flats Tertiary Composite Total Petroleum System assessment results.

[MMBO, million barrels of oil; BCFG, billion cubic feet of gas; MMBGL, million barrels of natural gas liquids; MAS, minimum accumulation size assessed [MMBO or BCFG]; Prob., probability of at least one accumulation equal to or greater than the MAS. Results shown are fully risked estimates. For gas fields, all liquids are included under the natural gas liquids category. F95 denotes a 95% chance of at least the amount tabulated. Other fractiles are defined similarly. Fractiles are additive only under the assumption of perfect positive correlation. Shading indicates not applicable.]

Assessment Unit	Accumulation type	MAS	Prob. (0-1)	Total undiscovered resources											
				Oil (MMBO)				Gas (BCFG)				Natural-gas liquids (MMBGL)			
				F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Tertiary Sandstone	Oil	0.5	0.81	0.00	106.77	560.35	165.57	0.00	103.49	565.05	165.80	0.00	6.04	34.46	9.97
	Gas	3						0.00	4,629.17	12,862.56	5,117.36	0.00	98.15	295.67	112.51
Subthrust	Oil	0.5	0.24	0.00	0.00	3.39	0.61	0.00	0.00	3.36	0.61	0.00	0.00	0.20	0.04
	Gas	3						0.00	0.00	92.91	15.94	0.00	0.00	2.04	0.35
Crooked Creek	Oil	0.5	0.48	0.00	0.00	28.75	6.47	0.00	0.00	29.06	6.55	0.00	0.00	1.76	0.40
	Gas	3						0.00	0.00	714.96	156.36	0.00	0.00	15.89	3.42
Coalbed Gas	Gas			Not quantitatively assessed											
Total undiscovered oil and gas resources				0.00	106.77	592.48	172.66	0.00	4,732.66	14,627.89	5,462.63	0.00	104.18	350.02	126.67





## Appendix 4. Doyon-Suggested Development Scenarios

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Doyon has suggested three conceptual oil/gas development scenarios. Their key differences are compared below:

### Conceptual 30,000 Acre Field

- 187 wells
- 2 drill sites
- 1 processing center
- 7-mile in-field road length
- Surface disturbance: 137 (air-supported field) to 207 (road-supported field)

#### Road-supported field (207 acres)

- Plant and infrastructure - 50 acres
- In-field roads and pads - 67 acres
- Field access road - 90 acres

#### Air-supported (137 acres)

- 20-acre runway instead of 90-acre access road

### Conceptual 70,000 Acre Field

- 438 wells
- 5 drill sites
- 1-2 processing center
- 9-mile in-field road length
- Surface disturbance: 164 (air-supported field) to 234 (road-supported field)

#### Road-supported field (237 acres)

- Plant and infrastructure - 30 acres
- In-field roads and pads - 114 acres
- Field access road - 90 acres

#### Air-supported (164 acres)

- 20-acre runway instead of 90-acre access road

### **Conceptual 127,000 Acre Field**

- 793 wells
- 9 drill sites
- 1-2 processing center
- 36-mile in-field road length
- Surface disturbance: 378 (air-supported field) to 448 (road-supported field)

#### **Road-supported field (448 acres)**

- Plant and infrastructure - 30 acres
- In-field roads and pads - 328 acres
- Field access road - 90 acres

#### **Air-supported (137 acres)**

- 20-acre runway instead of 90-acre access road





## Appendix 5. Subsistence Overview

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Rural residents rely upon customary and traditional use of natural resources in the Yukon Flats area. Although subsistence activities take place throughout wide areas of the Refuge, they are concentrated along rivers and near the villages. Village residents hunt moose, caribou, black bear, brown bear, Dall sheep, wolf, lynx, wolverine, waterfowl, grouse, and ptarmigan across the Flats. They also trap for wolf, wolverine, marten, lynx, muskrat, beaver, fox, and otter. Salmon (Chinook, summer and fall chum, coho) fishing occurs primarily along the Yukon River and into some of the major tributaries, such as the Porcupine and Chandalar Rivers. Fishing for non-salmon species, such as pike, sheefish, whitefish, grayling, arctic char, lake trout, and burbot, occurs in most waters of the area, but more in smaller streams, sloughs, and lakes than in the main Yukon. Other activities include wood gathering (house logs and firewood) and berry picking. Woodcutting for house logs primarily occurs along river corridors, generally upstream so cut logs can be floated downstream to the village. Local residents generally pick berries close to the villages.

Subsistence activities follow a traditional, seasonal cycle. Harvest cycles may vary slightly by village, but the general pattern is the same. Harvest seasons principally mirror the migration patterns of fish and wildlife species. Lengthening daylight and warming temperatures signal a shift from winter trapping to spring hunting and fishing. Waterfowl and muskrat harvest characterize spring activities, with peak harvest occurring in May. After break-up (ice going out of rivers), nets are set for non-salmon fish species, primarily whitefish and pike, and will continue through the fall. However, by late June to early July, salmon runs are reaching the upper Yukon River. Chinook are usually first, followed closely by summer chum in late July through August, then fall chum and coho by late August into September. Other fish species, such as burbot, longnose sucker or grayling, are caught primarily in September through November. Bear hunting begins in spring in some areas continuing through summer, but is generally concentrated in the fall. Berries normally ripen and are gathered late June to August. Moose hunting is primarily a fall activity, but hunting can begin in late August and continue through February or March. Peak moose harvest occurs in September and February. Waterfowl and small mammals are harvested incidentally with other hunting throughout the fall. Caribou occur sporadically in the Yukon Flats; harvest is occasional, but generally in the fall. Furbearer trapping season usually begins in November and goes through March. Beaver trapping is generally mid-February through March (Caulfield 1983, Sumida 1988, Sumida 1989).



Local residents within and near the Yukon Flats principally reside in eight villages: Beaver, Birch Creek, Central, Chalkyitsik, Circle, Fort Yukon, Stevens Village, and Venetie. The 2000 Census data recorded the total village population as 1313. The following table records the population by village:

**Yukon Flats Area Village Populations in 2000\***

<b>Village</b>	<b>Population</b>	<b>No. Households</b>	<b>% Native</b>
Beaver	84	31	95
Birch Creek	28	11	100
Central	134	67	10
Chalkyitsik	83	35	98
Circle	100	34	85
Fort Yukon	595	225	89
Stevens Village	87	35	95
Venetie	202	63	97
<b>Total</b>	<b>1,313</b>	<b>501</b>	

\*Source: Alaska Community Database Online 2004

*Beaver.* The village of Beaver is located on the north bank of the Yukon River within the traditional territory of the Deendu Gwich'in (Birch Creek Gwich'in). From its establishment in 1910, Beaver has had a unique multi-ethnic population including Arctic Coast and Kobuk Inupiat, Koyukon and Gwich'in Athabascans, Japanese, and Euro-Americans. Beaver residents traditionally harvest fish and wildlife along the Yukon River corridor from Fort Yukon downstream toward Stevens Village to Moose Island. Most moose, bear, and waterfowl hunting occurs within 15 miles of the Yukon River along the river corridors, interconnected lakes, and meadows. However, on the north side of the Yukon, hunting and furbearer trapping areas extend up the Hodzana River across the flats and foothills to Lone and Nelson Mountains, approximately 20 miles up the Hadweenzic River, and up the "government trail" (the old mail trail to the Chandalar mining district) nearly to the Chandalar River. Caribou hunting occurs principally along the "government trail," while waterfowl are primarily hunted in close proximity to the village. South of the Yukon River, hunting occurs along Beaver Creek, and traplines extend along Beaver and Lost Creek drainages, some into the White Mountains along the slopes of Mount Schwatka. Several cabins are located in this area, generally to the west of Mount Schwatka. Salmon fishing occurs generally close to the village along the channel and sloughs of the Yukon River, primarily from the mouth of the Hodzana River upstream to White Eye and Lower Birch Creek slough. Fishing for non-salmon species occurs in lakes, such as Elbow, Mud and Twin lakes, and sloughs, such as Marten, Howard, Elbow, and Joe Guay sloughs, and Yukon tributaries, such as the Hodzana and Hadweenzic Rivers and Beaver and Fish Creeks (Sumida 1989; Sumida and Alexander 1985).

*Birch Creek.* The Deendu Gwich'in of Birch Creek historically occupied much of the Yukon Flats south of the Yukon River to and including parts of the White and Crazy Mountains, and land south and east of the village of Beaver. Historical use of this area includes accounts of sheep hunting along Beaver Creek near Victoria Mountain, and report of a caribou and moose fence in the West

Crazy Mountains south of Birch Creek near the refuge boundary. Birch Creek residents use the area along upper and lower mouths of Birch Creek and along the Yukon River between White Eye and Fort Yukon extensively for hunting and trapping. They also use the extensive lake, river and slough systems between Birch and Beaver Creeks, and they hunt black bear and moose along Birch Creek upstream of the village to the Steese Highway bridge. Furbearer trapping also occurs along established trails south of the village into the foothills of the White Mountains near the headwaters of Preacher Creek and to the west along Beaver Creek. Salmon fishing occurs primarily on the Yukon River at the lower mouth of Birch Creek. Other non-salmon species are caught at sites along Birch Creek and its tributaries and in nearby lakes. Grayling are often caught in conjunction with hunting along the length of Birch Creek to the Steese Highway bridge crossing (Caulfield 1983; Sumida and Alexander 1985).

*Central.* The Gwich'in had used the Central area for thousands of years before Euro-Americans arrived. However, the community developed based almost entirely on Euro-American miners arriving in the Circle and Birch Creek Districts (Johnson, Interim Report). The village of Central grew up around a centrally located roadhouse (Central House built about 1894) on the supply trail crossing of Crooked Creek between Circle and mining operations on Mammoth, Mastodon, Preacher, and Birch Creeks. The Alaska Road Commission started constructing a wagon road in 1906 to connect Circle with the Birch Creek Mining District. The road reached Central in 1908 and Fairbanks in 1927, and was later named the Steese Highway (Alaska Community Database Online 2004). Today, residents of Central live in a loosely defined municipality of about 20 square miles around Central. While wage employment is a larger part of Central's economy, local residents still rely partly on subsistence to supplement their food and provide income from trapping and selling crafts. Big game species harvested most often include moose, caribou, Dall sheep, grizzly and black bear, and wolf. Moose, caribou, and sheep are generally found in the hills surrounding Central, and wolves are more common along creeks and rivers. Moose and bear also are taken close to roads or along rivers. Areas of interest specifically for this report include the Yukon River and around Medicine Lake. Other species hunted, particularly in fall, include bear, grouse, waterfowl, hare, and ptarmigan. Furbearer trapping for lynx, marten, fox, wolf, mink, weasel, and coyote occurs along Sheep, Woodchopper, Boulder, Coal, Ketchum, Crooked, and Birch Creeks, and probably Preacher Creek; the Yukon, Black, Porcupine, and Chena Rivers; and near Medicine Lake, Deadwood, and Circle Hot Springs. Most traplines are less than 50 miles long; however, some do extend up to 150 miles. Beaver and muskrat are harvested from nearby lakes and on Birch Creek. Fishing for both salmon and non-salmon species. Salmon fishing occurs mostly on the Yukon River. Non-salmon species, including grayling, whitefish, pike, sucker, sheefish, and ling cod are taken on Coal Creek, Birch Creek and other tributaries, as well as the Yukon River. Pike and whitefish also are taken from Medicine Lake (Johnson, Interim Report).

*Chalkyitsik.* People from Chalkyitsik consider themselves Dr'aanjik Gwich'in, which were a highly mobile band, historically using the area from the headwaters of the Black River, Salmon Fork, Little Black River, Porcupine River to the Canadian border, and the

lower Coleen River, as well as Ohtig Lake. Chalkyitsik residents still use this historical area, centered along the Porcupine and Black rivers. Moose hunting occurs generally along the Salmon Fork, Black, and Porcupine Rivers, and in the meadow areas south of the village. Caribou are occasionally harvested along the Porcupine River, Salmon Fork and Grayling Fork, as migration of the Porcupine Herd presents opportunity. Historically, Dr'aanjik Gwich'in harvested Dall sheep in mountains at the headwaters of Salmon Fork; however, Chalkyitsik residents interviewed in the early 1980s had not hunted sheep in that area. Muskrat are taken from the extensive lake, creek and slough systems from just north of the Porcupine River south to the Little Black and Grass Rivers. Waterfowl hunting primarily occurs at Ohtig Lake, along the Black and Porcupine Rivers, and other marshes and lakes near the community. Trappers travel long distances from the village along the Black, Little Black, Salmon Fork, Grayling Fork, Porcupine, and Coleen Rivers. Fishing for both salmon and non-salmon species occurs primarily in the Black River and its tributaries. Pike and whitefish also are taken from lakes near the village (Caulfield 1983).

*Circle.* The village of Circle was established in 1893 as a supply center for the mining district, but was largely vacated after the Klondike and Nome gold discoveries. At the peak of mining operations in the district, Circle had about 700 residents, mostly of Euro-American descent. As the village grew, local Gwich'in families began to settle in the area. As mining declined and news of new gold fields filtered into the community, miners and resident traders left in search of fortune elsewhere (Alaska Community Database Online 2004). Today, residents of Circle are principally Gwich'in, but there are several non-Native families in the village. The Gwich'in of Circle were known as Gwichyaa Gwich'in, having close family ties to Fort Yukon, with some ties to the Deendu Gwich'in of Birch Creek and the Dr'aanjik Gwich'in of Chalkyitsik (Johnson Interim Report). Circle residents also are linked with former residents of Medicine Lake (east of Circle Hot Springs). Information on Circle residents' traditional use areas is limited. Old village sites along the Yukon River, such as Twenty-six Mile and Twenty-two Mile Villages were used seasonally, and were connected by trails to Medicine Lake. Important areas for big game hunting and furbearer trapping include the Crazy Mountains, Ketchum Dome, Preacher Creek, Birch Creek, and Medicine Lake. Other trapping areas include Paddle Creek, Twelve Mile Bluff (downstream on the Yukon), with some traplines extending into the Black and Little Black River drainages. Waterfowl are hunted along the Yukon River and also in the numerous lakes near the village. Fishing for all species is primarily along the Yukon River, but some non-salmon species fishing occurs in nearby streams and lakes (Johnson Interim Report). The village of Circle is on the Alaska road system at the end of the Steese Highway.

*Fort Yukon.* People from the Fort Yukon area were known as the Gwichyaa Gwich'in. Their traditional territory ranged from the lower reaches of the Chandalar and Sheenjek Rivers south across the Yukon Flats and up the Yukon River to the Circle area. The confluence of the Porcupine and Yukon Rivers (present-day location of Fort Yukon) has always been a gathering place for the Gwichyaa Gwich'in. Fort Yukon residents hunt primarily along the river corridors of the Yukon, Black, Porcupine, Sheenjek and Christian, as well as the upper and lower mouths of Birch Creek, and Beaver

Creek and the many feeder streams, sloughs, oxbow lakes and adjacent ponds. Caribou hunting occurs along the Porcupine River from Graphite Lake to the Canadian border, and bear hunting is generally confined to areas within 25 miles of the village. Most hunting activities occur within a 50-mile radius of the community, and in winter, snowmachines facilitate access to areas outside the river corridors. Trapping areas were more expansive, ranging from downstream on the Yukon nearly to White Eye and upstream nearly to Twentytwo Mile Village. North of the Yukon trapping areas extended along the Sheenjek, Christian, lower Chandalar, middle Porcupine nearly to Shuman House, lower Coleen, Black, Little Black, Salmon Fork, Grass, and Sucker River drainages. South of the Yukon, trapping areas extended along Birch Creek and lower Beaver Creek drainages. Fort Yukon residents usually concentrate their salmon fishing along the Yukon River from the mouth of the Chandalar River (about 20 miles downstream of the village) to a point about 15 miles upstream of the village, but some fishing is concentrated in the lower Christian River near its confluence with the Yukon and Chandalar Rivers. Fishing for non-salmon species occurs on the Yukon, Porcupine, Sheenjek, Black, Grass, and Sucker Rivers, as well as nearby lakes (Caulfield 1983; Sumida and Andersen 1990).

*Stevens Village.* Stevens Village is a Koyukon Athabascan community of the Upper Koyukon band, which occupied areas along the Yukon river from Stevens Village downriver to the mouth of the Koyukuk River. The residents of Stevens Village describe their ancestral land as “North to and including the Dall Rivers’ (Dall and Little Dall) watershed, to the west as far and including Ray River, to the east as far and including Purgatory, and south to the summit of the range of hills commonly called the Rogers Creek Range; the lakes and streams, therein, and the unpatented lands drained thereby. These Ancestral lands are bounded by the Dall Rivers, Woodcamp Creek, Waldron Creek, Alfred Creek, Rogers Creek, Olda Lost Creek, and portions of the Ray River watersheds” (Stevens Village Land Use Plan 1999, p.6). Most hunting generally occurs along the Yukon River corridor, sloughs, and islands upriver from the village as far as Beaver and downriver to the upper reaches of the canyon, up the Dall River, Little Dall River, and northeast nearly to Lone Mountain as well as the extensive marshes and wetlands north of the village. South of the Yukon, hunting occurs along Rogers Creek, and the lower reaches of Lost Creek. Hunting activities in the Ray River area have been curtailed since the Trans Alaska Pipeline and Dalton Highway were built. Traditional trapping areas included most of the area described as ancestral lands, extending up to the Hodzana River, and south of the Yukon along Lost and Rogers Creeks. Salmon are traditionally harvested along the Yukon River from about 15 miles downstream of the Dalton Highway bridge upstream to near Marten Island. Non-salmon species also are caught in the Yukon River as well as the larger tributaries including the Dall River, Little Dall River, Lost Creek, and the Ray River (Sumida and Alexander 1985; Sumida 1988).

*Venetie.* Residents of Venetie are largely descendants of the Neets’aii Gwich’in, with some ties to the Gwichyaa Gwich’in, and the remnants of the little-known Dihaii Gwich’in that are thought to have occupied the territory between the Chandalar and Middle Fork Koyukuk Rivers in the northern portion of the

Yukon Flats and including the southern Brooks Range. Traditional land use for Venetie residents is primarily within the Venetie Tribal Lands, but traditional use also occurs along the Chandalar River downstream from the village to its mouth on the Yukon River. Fishing, particularly for salmon, occurs on the Yukon River downstream from Chandalar nearly to White Eye and upstream to Fort Yukon, as well as on the Chandalar River. Similar to other communities on the flats, Venetie residents harvested non-salmon fish from the Chandalar River, its tributaries, as well as large lakes such as Venetie Lake, Ackerman, and Vunittsieh, where trapping and subsistence hunting for moose, caribou, sheep, muskrat, and waterfowl also were documented in the early 1980s (Caulfield 1983).



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## List of Preparers

---

### **Yukon Flats National Wildlife Refuge**

Mark Bertram	Lead Wildlife Biologist
Wennona Brown	Refuge Subsistence Coordinator
Sheila Dufford	GIS Specialist
Jimmy Fox	Refuge Operations Specialist
Ted Heuer	Refuge Manager
Sam Patten	Fire Management Officer
Delia Person	Refuge Operations Specialist
Michael Vivion	Wildlife Biologist/Airplane Pilot
Barry Whitehill	Deputy Refuge Manager

### **Fairbanks Fish and Wildlife Field Office**

Jeff Adams	Branch Chief, Assessment and Monitoring
Randy Brown	Fishery Biologist
Mitch Osborne	Fishery Biologist
Louise Smith	Fish and Wildlife Biologist

### **Division of Realty**

Warren Keogh	Navigable Waters Specialist
Kim Milton	Cartographer
Rob Siciliano	Cartographer
John Trawicki	Regional Hydrologist

### **Division of Conservation, Planning, and Policy**

Cyndie Wolfe	Wildlife Biologist
--------------	--------------------

YuKon Flats National Wildlife Refuge  
101 12th Avenue  
Room 264, Box 14  
Fairbanks, Alaska 99701

Phone: 907-456-0440  
Email: [yukonflats@fws.gov](mailto:yukonflats@fws.gov)

